3.7 implicit differentiation

explicit $y = -x^2 + x$

implicit $y + x^2 - x = 0$

x's, y's mixed together

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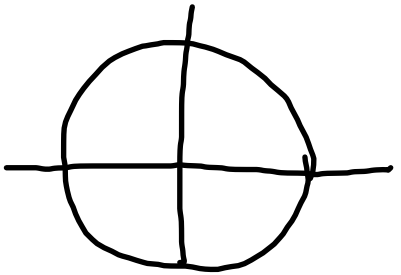
ex.. $x^2 + y^2 = 1$



implicit

explicit (solve for y) $y = \pm\sqrt{1 - x^2}$

$$y^4 + 2xy + y^2 = 8$$

implicit

explicit may be hard / impossible

$y = -x^2 + x$ find $\frac{dy}{dx}$

$\frac{dy}{dx} = -2x + 1$ explicit

$y + x^2 - x = 0$ implicit

take der of each term

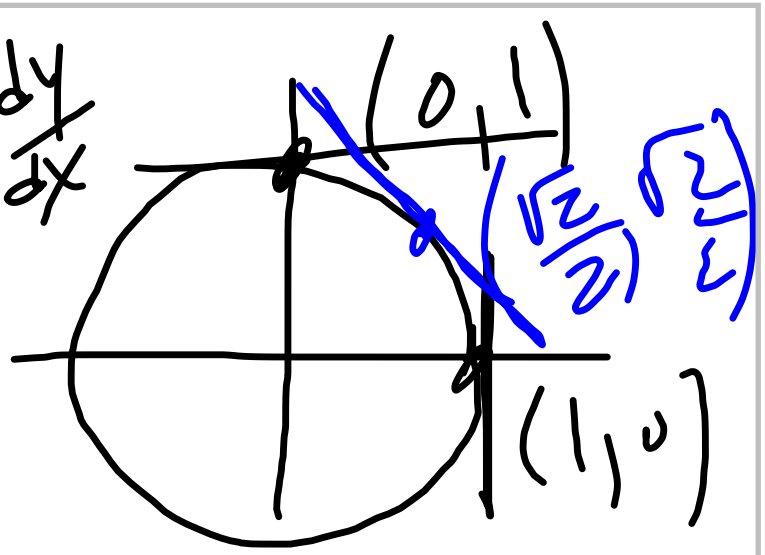
$\frac{dy}{dx} + 2x - 1 = 0$ solve for $\frac{dy}{dx}$

$\frac{dy}{dx} = -2x + 1$

$x^2 + (y)^2 = 1$ — out

y — in

find $\frac{dy}{dx}$



$$2x + 2y \cdot \frac{dy}{dx} = 0$$

$$\frac{2y\frac{dy}{dx}}{2y} = \frac{-2x}{2y} = -\frac{x}{y}$$

$$\frac{dy}{dx} = -\frac{x}{y}$$

$(y)^4 + 2xy + y^2 = 8$ find $\frac{dy}{dx}$

$4y^3 \frac{dy}{dx} + \left(2x \cdot \frac{dy}{dx} + y \cdot 2\right) + 2y \frac{dy}{dx} = 0$

$4y^3 \frac{dy}{dx} + 2x \frac{dy}{dx} + 2y \frac{dy}{dx} = -2y$

$\frac{dy}{dx}\left(4y^3 + 2x + 2y\right) = -2y$

$\frac{dy}{dx} = \frac{-2y}{4y^3 + 2x + 2y} = \frac{-y}{2y^3 + x + y}$

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EX 5 $2x^3 - 3y^2 = 8$ find y''

first get y' $6x^2 - 6yy' = 0$

$$y' = \frac{-6x^2}{-6y} = \frac{x^2}{y}$$

find y'' $y' = \frac{x^2}{y}$

$$y'' = \frac{y \cdot 2x - x^2 \cdot y'}{y^2}$$

$$y'' = \frac{y}{y}\frac{2xy - x^2\frac{x^2}{y}}{y^2} = \left(\frac{\frac{2xy^2 - x^4}{y}}{y^2}\right)$$

$$y'' = \frac{2xy^2 - x^4}{y^3}$$